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TITLE: RECORDING APPARATUS, RECORDING METHOD,
AND DISC SHAPED RECORD MEDIUM

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RECORDING APPARATUS, RECORDING METHOD,

AND DISC SHAPED RECORD MEDIUM

<u>BACKGROUND OF THE INVENTION</u>

<u>Field of the Invention</u>

5   The present invention relates to a record
apparatus, a recording method, and a disc shaped record
medium that allow a reproducing operation and/or an
editing operation to be easily performed.

<u>Description of the Related Art</u>

10   In a recording apparatus such as a camcorder
that records video data and/or audio data, several
pictures and a sound thereof are recorded as a file.
Such a recording and reproducing apparatus may have a
display portion such as a liquid crystal display panel
15 and a sound generating portion such as a speaker that
allow recorded data to be reproduced and/or edited. In
such a recording and reproducing apparatus, when a
random-accessible record medium such as a magneto-
optical disc is used, the user can designate a file so
20 as to select his or her desired program to be
reproduced or edited.

          In recent years, as a multi-media system
software program, QuickTime is known. The QuickTime is
a software program that allows data that varies on time
25 base (this data is referred to as movie) to be handled.
A movie contains a moving picture, a voice, and a text.
Currently, a QuickTime file format is available as a

Macintosh platform of Apple. The QuickTime file format is an MPEG-1 (Moving Picture Experts Group phase 1) program stream file storage format of which a video elementary stream and an audio elementary stream are multiplexed on time base). In the storage format, the entire MPEG-1 file (namely, one whole closed scene) is treated as a sample of the QuickTime file format regardless of the duration thereof. Such a large sample is treated as one large chunk.

In addition, audio data and video data are stored together on one track (or one medium) in the QuickTime file format. As a new medium type that represents such data portions contained in a large sample or a large chunk, MPEG Media has been defined.

In this case, a file is designated by inputting for example a file name or the like. However, when many files have been recorded, since it is difficult for the user to memorize a file name and so forth of a file for which he or she wants to perform a reproducing operation, an editing operation, or the like, the operability of the apparatus may deteriorate.

OBJECTS AND SUMMARY OF THE INVENTION

Therefore, an object of the present invention is to provide a recording apparatus, a recoding method, and a disc shaped record medium that allow a reproducing operation and/or an editing operation to be easily performed.

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A first aspect of the present invention is a
digital recording apparatus using a disc shaped record
medium, comprising a means for extracting outlined
information of each of a plurality of files recorded on
the disc shaped record medium, a means for correlating
the extracted outlined information and the plurality of
files and generating an index file, and a means for
recording the index file to a predetermined position of
the disc shaped record medium, wherein when a
predetermined operation mode is performed, a plurality
of types of data of the plurality of files are output
in a predetermined format.

A second aspect of the present invention is a
digital recording method using a disc shaped record
medium, comprising the steps of extracting outlined
information of each of a plurality of files recorded on
the disc shaped record medium, correlating the
extracted outlined information and the plurality of
files and generating an index file, and recording the
index file to a predetermined position of the disc
shaped record medium, wherein when an operation mode
including a reproducing operation is performed, a
plurality of types of data of the plurality of files
are output in a predetermined format.

A third aspect of the present invention is a
disc shaped record medium for recording a plurality of
files and an index file, the index file correlating

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outlines information of the plurality of files and the plurality of files, the index file being recorded at a predetermined position of the disc shaped record medium.

According to the present invention, outlined information of each of a plurality of files recorded on a disc shaped record medium is output. Desired data can be easily searched from the outlined information.

The applicant of the present invention has the following patents as prior patents of the present invention:

(1)   US Pantet No. 4,945,475

(2)   US Patent No. 5,253,053

(3)   US Patent No. 5,652,879

These and other objects, features and advantages of the present invention will become more apparent in light of the following detailed description of a best mode embodiment thereof, as illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram showing an example of the structure of a digital recording and reproducing apparatus according to an embodiment of the present invention;

Fig. 2 is a schematic diagram showing an example of the outer shape of the embodiment of the present invention;

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Fig. 3 is a schematic diagram showing an example of indication portions displayed on a display panel;

Fig. 4 is a schematic diagram showing an example of a QuickTime movie file;

Fig. 5 is a schematic diagram showing an example of an index file according to the present invention;

Fig. 6 is a table for explaining a property track in detail;

Fig. 7 is a table for explaining property data in detail;

Fig. 8 is a table for explaining a part of the property data in more detail;

Fig. 9 is a table for explaining a title track in detail;

Fig. 10 is a table for explaining a thumbnail track in detail;

Fig. 11 is a table for explaining an intro-music track in detail;

Fig. 12 is a schematic diagram for explaining a designation for real data on the property track and so forth;

Fig. 13 is a schematic diagram for explaining a designation issued from another file for a part of data contained in a move data portion;

Fig. 14 is a schematic diagram for explaining

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a hierarchical structure of a directory; and

Fig. 15 is a schematic diagram for explaining a record position of an index file.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 shows an example of the structure of a digital recording and reproducing apparatus according to an embodiment of the present invention. An optical system (not shown) photographs a picture and supplies photographed light thereof to an image pickup device such as a CCD (Charge Coupled Device). The CCD generates a video signal corresponding to the photographed light and supplies the generated video signal to a video encoder 1 shown in Fig. 1. The video encoder 1 compression-encodes the video signal. In addition, an audio signal generating portion such as a microphone generates an audio signal and supplies it to an audio encoder 2. The audio encoder 2 compression-encodes the audio signal. The compression-encoding method applied for the video signal and the audio signal is for example MPEG. Output signals of the video encoder 1 and the audio encoder 2 are referred to as elementary streams.

When MPEG is used, the video encoder 1 is composed of a motion predicting portion, a picture sequence rearranging portion, a subtracting portion, a DCT portion, a quantizing portion, a variable length code encoding portion, and a buffer memory. The motion

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predicting portion detects a moving vector. The

subtracting portion forms a predictive error between an

input picture signal and a locally decoded picture

signal. The DCT portion transforms an output signal of

5   the subtracting portion corresponding to the DCT

method. The quantizing portion quantizes an output

signal of the DCT portion. The variable length

encoding portion encodes an output signal of the

quantizing portion into a signal having a variable

10   length. The buffer memory outputs the encoded data at

a constant data rate. The picture sequence rearranging

portion rearranges the sequence of pictures

corresponding to the encoding process. In other words,

the picture sequence rearranging portion rearranges the

15   sequence of pictures so that after I and P pictures are

encoded, a B picture is encoded. The local decoding

portion is composed of an inverse quantizing portion,

an inverse DCT portion, an adding portion, a frame

memory, and a motion compensating portion. The motion

20   compensating portion performs all of a forward

predicting operation, a reverse predicting operation,

and a bidirectional predicting operation. When the

intra encoding process is performed, the subtracting

portion directly passes data, not performs the

25   subtracting process. The audio encoder 2 comprises a

sub-band encoding portion and an adaptively quantized

bit allocating portion.

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As an example, in the case of a portable disc recording and reproducing apparatus with a built-in camera, a picture photographed by the camera is input as video data. In addition, a voice collected by a microphone is input as audio data. The video encoder 1 and the audio encoder 2 convert analog signals into digital signals. According to the embodiment of the present invention, a rewritable optical disc is used as a record medium. Examples of such an optical disc are a magneto-optical disc and a phase-change type disc. According to the embodiment of the present invention, a magneto-optical disc having a relatively small diameter is used.

Output signals of the video encoder 1 and the audio encoder 2 are supplied to a file generator 5. The file generator 5 converts output signals of the video encoder 1 and the audio encoder 2 into a video elementary stream and an audio elementary stream so that they can be handled corresponding to a computer software program for synchronously reproducing a moving picture and a sound without need to use a dedicated hardware portion. According to the embodiment of the present invention, for example, as such a software program, QuickTime is used. QuickTime is a software program that allows various types of data such as a still picture, a text, an audio sound, and MIDI (Musical Instrument Digital Interface) as well as a

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moving picture to be handled and controlled on time base. A file that contains various types of data using QuickTime is referred to as QuickTime movie file.

5   The file generator 5 multiplexes encoded video data and encoded audio data. To generate a QuickTime movie file, a system controlling microcomputer 9 controls the file generator 5. An index file according to the present invention is also

10   generated by the file generator 5.

QuickTime movie files generated by the file generator 5 are successively written to a memory 7 through a memory controller 8. When the system controlling microcomputer 9 issues a data write request

15   for a disc to the memory controller 8, the memory controller 8 reads a QuickTime movie file from the memory 7. In this example, the transfer rate of the encoding process for a QuickTime movie file is lower than that for data written to the disc. For example,

20   the former is half of the latter. Thus, although QuickTime movie files are successively written to the memory 7, they are intermittently read from the memory 7 under the control of the system controlling microcomputer 9 in such a manner that the memory 7 is

25   prevented from overflowing or underflowing.

A QuickTime movie file that is read from the memory 7 through the memory controller 8 is supplied to

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an error correction encoder/decoder 11. The error

correction encoder/decoder 11 temporarily writes a

QuickTime movie file to a memory 10. The error

correction encoder/decoder 11 performs an interleaving

process and an error correction code encoding process

so as to generate redundant data. The error correction

encoder/decoder 11 reads the QuickTime movie file with

redundant data from the memory 10.

Output data of the error correction

encoder/decoder 11 is supplied to a data

modulator/demodulator 13. When digital data is

recorded on the disc, the data modulator/demodulator 13

modulates the data in such a manner that a clock signal

can be easily extracted so that data can be recorded on

a disc free from a problem such as an inter-code

interference.

An output signal of the data

modulator/demodulator 13 is supplied to a magnetic

field modulating driver 14. In addition, a signal for

driving an optical pickup 23 is output to the magnetic

field modulating driver 14. The magnetic field

modulating driver 14 drives a magnetic field head 22

corresponding to the input signal so as to apply a

magnetic field to an optical disc 20. The optical

pickup 23 radiates a recording laser beam to the

optical disc 20. In such a manner, data is recorded on

the optical disc 20. The optical disc 20 is rotated at

CLV (Constant Linear Velocity), CAV (Constant Angular Velocity), or ZCAV (Zone CLV of which the disc surface area is divided into for example three areas in each of which the optical disc 20 is rotated at CAV in such a manner that the velocity of the innermost area is the highest and the velocity of the outermost area is the lowest) so that their linear velocities nearly become the same.

Since data that is intermittently read from the memory controller 8 is recorded to the optical disc 20, data is not successively recorded. In other words, after a predetermined amount of data is recorded, the recording operation is stopped until the next record request is received.

When the system controlling microcomputer 9 issues a request to a drive controlling microcomputer 12, it issues a request to a servo circuit 15 so as to control the entire disc drive. Thus, the disc drive performs a recording operation. The servo circuit 15 performs a disc radial moving servo operation, a tracking servo operation, and a focus servo operation for the optical pickup 23. In addition, the servo circuit 15 performs a spindle servo operation for a motor 21. In association with the system controlling microcomputer 9, a user operation input portion (not shown) is disposed.

Next, the structure and operation of the

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reproducing portion will be described. When data is
reproduced, a reproducing laser beam is radiated to the
optical disc 20. A detector of the optical pickup 23
converts the reflected light of the optical disc 20

5   into a reproduction signal. A tracking error and a
focus error are detected from an output signal of the
detector of the optical pickup 23. The servo circuit
15 controls the optical pickup 23 so that the optical
pickup 23 is placed and focused on a desired track. In

10   addition, the servo circuit 15 controls the radial
movement of the optical pickup 23 so that it reproduces
data on a desired track of the optical disc 20.

       As with the recording operation, when data is
reproduced, the transfer rate of data reproduced from

15   the optical disc 20 is higher than that of a QuickTime
movie file. For example, the transfer rate of data
reproduced form the optical disc 20 is twice as large
as the transfer rate of a QuickTime movie file.
Likewise, data is not successively reproduced from the

20   optical disc 20. In other words, an intermittent
reproducing operation is performed in such a manner
that after a predetermined amount of data is
reproduced, the reproducing operation is stopped until
the next reproducing request is received. As with the

25   recording operation, in the reproducing operation, when
the system controlling microcomputer 9 issues a request
to the drive controlling microcomputer 12, it issues a

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request to the servo circuit 15 so as to control the entire disc drive.

The reproduction signal that is output from the optical pickup 23 is input to the data modulator/demodulator 13. The data modulator/demodulator 13 demodulates the reproduction signal. The demodulated data is supplied to the error correction encoder/decoder 11. The error correction encoder/decoder 11 temporarily writes the reproduction data to the memory 10. The error correction encoder/decoder 11 performs a deinterleaving process and an error correcting process for the reproduction data. The error-corrected QuickTime movie file is written to the memory 7 through the memory controller 8.

A QuickTime movie file written to the memory 7 is output to a file decoder 6 in synchronization with a demultiplexing timing corresponding to a request issued by the system controlling microcomputer 9. The system controlling microcomputer 9 supervises the amount of data that is reproduced from the optical disc 20 and written to the memory 7 and the amount of data that is read from the memory 7 and output to the file decoder 6 so as to successively reproduce the video signal and the audio signal. In addition, the system controlling microcomputer 9 controls the memory controller 8 and the drive controlling microcomputer 12

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so as to read data from the optical disc 20 in such a manner that the memory 7 does not overflow or underflow.

The file decoder 6 decodes a QuickTime movie file into a video elementary stream and an audio elementary stream under the control of the system controlling microcomputer 9. The video elementary stream is supplied to a video decoder 3. The audio elementary stream is supplied to an audio decoder 4. The video elementary stream and the audio elementary stream are synchronously output from the file decoder 6.

The video decoder 3 and the audio decoder 4 compression-decode the video elementary stream and the audio elementary stream and generate a video output signal and an audio output signal, respectively. In this example, the video signal and the audio signal have been encoded corresponding to MPEG. The video decoder 3 is composed of a buffer memory, a variable length code decoding portion, an inverse DCT portion, an inverse quantizing portion, an adding portion, and a local decoding portion. The adding portion adds an output signal of the inverse quantizing portion and a local decoded output signal. The local decoding portion is composed of a picture sequence rearranging portion, a frame memory, and a motion compensating portion.

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When an intra encoding process is performed, the adding portion directly passes data, not performs the adding process. Decoded data is output from the adding portion to the picture sequence rearranging portion. The picture sequence rearranging portion rearranges the decoded pictures in the original order. Output data of the video decoder 3 is supplied to a display portion (not shown). The display portion is for example an LCD (Liquid Crystal Display). The output data of the video decoder 3 may be supplied to an external picture display device through an external output terminal. Output data of the audio decoder 4 is supplied to a sound generating portion (not shown). The sound generating portion is for example a speaker. Alternatively, the output data of the audio decoder 4 may be supplied to an external audio generating device through an external output terminal.

As was described above, since the optical disc 20 on which data is recorded is attachable and detachable, the data recorded on the optical disc 20 can be reproduced by another apparatus. For example, a personal computer that operates with QuickTime application software may read data recorded on the optical disc 20 and reproduce video data and audio data therefrom. It should be noted that the present invention can be applied to an apparatus that handles only video data or only audio data.

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Fig. 2 is a perspective view showing the external structure of the embodiment of the present invention. Referring to Fig. 2, a lens 210 is an objective lens disposed at the forward end of the optical system. A display panel 220 displays a reproduced picture and indications corresponding to an operation mode. The display panel 220 has a display device such as an LCD and a piezoelectric device. By touching each indication portion with a pointing device 230, the user or the like can input an operation command for a reproducing operation and so forth.

When a random-accessible disc shaped record medium is used, the user can select a desired file by inputting for example a file name thereof. However, when many files have been recorded on the record medium, it is difficult for the user to memorize the file name of the desired file. Thus, the operability for the reproducing operation and the editing operation may deteriorate. To solve such a problem, according to the embodiment of the present invention, as shown in Fig. 3, representative pictures P1 to P9 (referred to as thumbnail pictures) of for example nine files are displayed on the display panel 220 so that the user can select a desired file with reference thereto. When the user presses a desired thumbnail picture with the pointing device 230, he or she can select the desired file.

When the user presses indication portions
223, 224, 225, 226, 227, and 228 with the pointing
device 230, he or she can input his or her desired
command for a reproducing operation, an editing

5   operation, or the like for a selected file. In this
example, a sound corresponding to the picture selected
with the pointing device 230 can be reproduced for a
predetermined time period (for example, several
seconds).

10   An indication portion 221 indicates an
operation mode such as a reproducing and editing
operation, a recording operation, or the like. On the
other hand, an indication portion 222 indicates a
recordable remaining time period. An indication

15   portion 229 indicates a scroll bar that allows
thumbnail pictures that cannot be displayed at a time
to be displayed corresponding to a scrolling operation
of an indication portion 229a operated with the
pointing device 230. Thus, even if more than nine

20   thumbnails have been recorded, they can successively
displayed by the scrolling operation.
        As a method for searching a file, according
to the embodiment of the present invention, an index
file that contains a set of parts of picture data

25   and/or audio data of a plurality of files recorded on
the disc shaped record medium is generated. The
generated index file is recorded at a predetermined

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position of the disc shaped record medium. The index file can be generated in for example the QuickTime movie file format.

Next, a QuickTime movie file will be described. Fig. 4 shows an example of a QuickTime movie file that allows both audio data and video data to be handled. The major structural portions of a QuickTime movie file are a movie resource portion and a movie data portion. The movie resource portion contains data that represents the duration for reproducing the file and data for referencing real data. The movie data portion contains real data of video data, audio data, and so forth.

Next, the movie resource portion will be described in detail. The movie resource portion contains a movie header 41 and tracks. The movie header 41 contains general file information. There are a plurality of tracks corresponding to the number of types of data. Fig. 4 shows an example of the internal structure of a video track 50 in detail. The video track 50 contains a track header 42 and a medium portion. The track header 42 contains general track information. The medium portion contains a medium header 43, a medium handler 44, and a medium information portion. The medium header 43 contains general medium information. The medium handler 44 contains medium data handling information.

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The medium information portion contains a medium handler 45, a data handler 46, data information 47, and a sample table. The medium handler 45 contains picture medium information. The data handler 46 contains picture data handling information. The data information 47 contains data information. The sample table contains a sample description, a time-to-sample, a sample size 48, a sample-to-chunk, a chunk offset 49, a sync sample, and so forth. The sample description contains each sample. The time-to-sample represents the relation between a sample and the time base. The sample size 48 represents the size of the sample. The sample-to-chunk represents the relation between the sample and the chunk. The chunk offset 49 represents the start byte position of the chunk in the movie file. The sync sample contains synchronous information. In the QuickTime movie file format, the minimum data unit (for example, a picture in MPEG encoded data) is treated as a sample. As a set of samples, a chunk is defined. To improve the accessibility of data that is recorded and reproduced, successive samples are recorded in a chunk. An audio track 51 has a structure (not shown) similar to that of a video track.

On the other hand, the movie data portion contains audio data encoded corresponding to for example MPEG Audio Layer 2 and picture data encoded in the compression-encoding method corresponding to for

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example MPEG (Moving Picture Expert Group) method in the unit of chunks each of which is composed of a predetermined number of samples. However, it should be noted that the present invention is not limited to such an encoding method. In addition, the moving data portion may contain linear data that has not been compression-encoded.

Each track of the movie resource portion is correlated with data contained in the movie data portion. In other words, in the example shown in Fig. 3, since audio data and video data are handled, the movie resource portion contains a video track and an audio track. The movie data portion contains real data of the audio data and real data of the video data. When other types of data are handled, the movie resource portion contains their tracks and the movie data portion contains real data thereof. For example, when a text and MIDI are handled, the movie resource portion contains tracks of the text and the MIDI and the movie data portion contains real data thereof.

According to the embodiment of the present invention, an index file is generated with a QuickTime movie file. The index file handles data corresponding to types of data handled in a file to be searched. In this example, it is assumed that a file to be searched contains video data and audio data (hereinafter this file is referred to as AV file). In this case, the

index file handles four types of data that are a property, a title, a thumbnail picture, and an intro-music. The property represents the attribute of the AV file. The title represents the title of the AV file. The thumbnail picture is a representative picture of for example the first picture of the AV file. The intro-music is typical audio data of for example the first several seconds of the AV file.

Fig. 5 shows an example of the structure of the index file generated with a QuickTime movie file. In this example, the movie resource portion contains tracks corresponding to four types of data that are a property track 62, a title track 63, a thumbnail picture track 64, and an intro-music track 65 as well as a movie header 61. However, only the property track 62 is an essential track. The other tracks are used corresponding to the types of data that the index file handles. In this example, the movie data portion contains four types of real data that are a property, a title, a thumbnail picture, and an intro-music. Likewise, only the property data is essential data. The other types of real data are used corresponding to the types of data that the index file handles.

Fig. 6 shows a table of an example of the property track 62. Each of AV File Property #1, AV File Property #2, ..., and AV File Property #n defined

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as chunks of properties of individual AV files has a data length (variable length represented in bytes) (L_AP1, L_AP2, ..., and L_APn) and a start byte position (0, L_AP1, L_AP1 + L_AP2, ...).

Fig. 7 shows an example of property data (real data) of each AV file. One byte starting with byte 0 represents version information. Two bytes starting with byte 1 represent a flag area (that will be described later). One byte starting with byte 3 represents a data type such as a moving picture, a still picture, audio, or the like. Four bytes starting with byte 4 represents date and time of creation of the AV file. Four bytes starting with byte 8 represents date and time of last change of the AV file.

Four bytes starting with byte 12 represent the duration of the reproduction of the AV file. L_F1 bytes (variable bytes) starting with byte 16 represent the file name of the AV file. Thus, as was described above, the data lengths of property data of the AV files are represented as variable length L_AP1, L_AP2, ..., and L_APn.

Fig. 8 shows an example of the structure of the flag area. When the recorded data is a file, bit 0 is 0. When the recorded data is a set of grouped files or a directory, bit 0 is 1. When there is no file to be referenced to the AV file, bit 1 is 0. When there is a file to be referenced to the AV file, bit 1 is 1.

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When the AV file does not contain a title, bit 2 is 0. When the AV file contains a title, bit 2 is 1. When the index file contains data of a title, bit 3 is 0. When data of a title is contained in an AV file designated by property data, bit 3 is 1. When the AV file does not contain a thumbnail picture, bit 4 is 0. When the AV file contains a thumbnail picture, bit 4 is 1.

When the index file contains data of a thumbnail picture, bit 5 is 0. When an AV file designated by property data contains data of a thumbnail picture, bit 5 is 1. When the AV file does not contain data of an intro-music, bit 6 is 0. When the AV file contains data of an intro-music, bit 6 is 1. When the AV file contains data of an intro-music, bit 7 is 0. When an AV file designated by property data contains data of an intro-music, bit 7 is 1. Bits 8 to 15 are reserved.

Fig. 9 shows a table of an example of the structure of the title track 63. According to the embodiment of the present invention, a title can be registered to each AV file to be searched. The registered title is placed as real data in the movie data porion. The data length and the start position of the title of each AV file are represented with the title track. As shown in Fig. 9, the title track is defined as a chunk corresponding to title data of each

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AV file. Each of AV File Title #1, AV File Title #2, ..., and AV File Title #n defined as chunks of title data of the individual AV files has a data length (variable length represented in bytes) L_AT1, L_AT2, ..., and L_ATn and a start byte position 0, L_AT1, L_AT1 + L_AT2, ...

Fig. 10 shows an example of the structure of the thumbnail picture track 64. According to the embodiment of the present invention, one thumbnail picture can be registered to each AV file to be searched. The registered thumbnail picture is placed as real data in the movie data portion. The data length and the start position of a thumbnail picture of each AV file are represented with the thumbnail track. Each of AV File Thumbnail #1, AV File Thumbnail #2, ... and AV File Thumbnail #n defined as chunks of thumbnail data of individual AV files has a data length (variable length represented in bytes) L_TH1, L_TH2, ..., and L_THn and a start byte position 0, L_TH1, L_TH1 + L_TH2, ...

Fig. 11 shows an example of the structure of the intro-music track 65. According to the embodiment of the present invention, one intro-portion (of for example the first five seconds) of audio data can be registered to each AV file to be searched. An intro-music to be registered is placed as real data in the movie data portion. The data length and the start

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position of an intro-music of each AV file are represented with the intro-music track. Each of AV File Intro Music #1, AV File Intro Music #2, ... and AV File Intro Music #n defined as chunks of intro-musics of individual AV files has a data length (variable length represented in bytes) L_IS1, L_IS2, ..., and L_ISn and a start byte position 0, L_IS1, $L\_IS1 + L\_IS2$, ...

In the QuickTime movie file format, data contained in the property track 62, the title track 63, the thumbnail picture track 64, the intro-music track 65, and so forth is represented in the QuickTime movie file format as shown in Fig. 12. As was described above, the medium information portion of each track of the movie resource portion contains a sample size table and a chunk offset table (see Fig. 4). The sample size tables of the property track 62, the title track 63, the thumbnail picture track 64, and the intro-music track 65 contain property data, title data, thumbnail picture data, and intro-music data of each AV file.

$S11$, $S12$, ..., $S1n$ represent the sizes of property data of AV File #1, AV File #2, ..., and AV File #n, respectively. $S31$, $S32$, .., $S3n$ represent the sizes of data of thumbnail pictures of AV File #1, AV File #2, ..., and AV File #n, respectively. $S41$, $S42$, ..., and $S4n$ represent the sizes of intro-music data of AV File #1, AV File #2, ..., and AV File #n,

respectively.

Likewise, the chunk offset table contains record start byte positions of the property, the title, the thumbnail picture data, and the intro-music data of each AV file. O11, O12, ... , and O1n represent the start byte positions of property data of AV File #1, AV File #2, ..., and AV File #n, respectively. O21, O22, ..., O2n represent the start byte positions of the titles of AV File #1, AV File #2, ..., and AV File #n, respectively. O31, O32, ..., and O3n represent the start byte positions of the thumbnail pictures of AV File #1, AV File #2, ..., and AV File #n, respectively. O41, O42, ..., and O4n represent the start byte positions of the intro-music data of AV File #1, AV File #2, ..., and AV File #n, respectively.

In the above-described structure, the property data, the title data, the thumbnail picture data, the intro-music data, and so forth of each AV file can be accurately accessed in the movie data portion.

In the above description, data to be searched is output corresponding to an AV index file containing a movie resource portion and a movie data portion. Alternatively, by designating data contained in the movie data portion of another index file with a file containing only a movie resource portion, video data, audio data, and so forth to be searched can be output.

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Next, such a case will be described. It is assumed
that an AV Index File #0 containing a movie resource
portion and a movie data portion and an AV Index File
#1 containing only a movie resource portion have been

5   recorded as shown in Fig. 13. When bit 0 of the flag
area of the property data of AV Index File #0 is "1",
recorded data is a set of grouped files or a directory
(see Fig. 8). As a source portion of real data
contained in a set of grouped files or a directory, AV

10   Index File #1 is designated.

AV Index File #1 contains a part of the movie
data portion of AV Index File #0 (for example, the data
size, the start byte position, and so forth of each of
the property data, the title data, and the thumbnail

15   picture data of each AV file as shown in Fig. 13).
Alternatively, AV Index File #1 can designate only a
part of movie data portion of AV Index File #0
corresponding to a particular AV file. Thus, only one
of stored title data, thumbnail picture data, intro-

20   music data, and so forth can be output so as to search
a desired AV file. Alternatively, a process for
outputting data corresponding to only a part of AV
files recorded on the record medium can be performed.
Thus, the user can filter a search range and then

25   perform a searching operation.

In addition, data contained in the movie
resource portion of the index file may be correlated

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with data contained in the movie data portion of another index file. For example, when bit 5 of the flag area of the property data of AV Index File #0 is "1", data of the thumbnail picture is contained in a file designated by the property track (see Fig. 8). The designated file is QT Movie File #1. QT Movie File #1 contains a movie resource portion and a movie data portion. The movie data portion contains thumbnail picture data and conventional video data.

Thus, data to be searched can be handled in other than the above-described index file format. Thus, the format of a file to be searched becomes more flexible. The movie data portion of QT Movie File #1 contains data of the thumbnail picture. Alternatively, the movie data portion may contain title data and intro-music data. In this case, bit 7 of the flag area of the property data of AV Index File #0 is "1".

When bit 0 of the flag area of the property data is "1" and recorded data is a set of grouped files or a directory, data can be hierarchically handled. In other words, as shown in Fig. 14, index file AVIF0000.MOV containing a movie resource portion and a movie data portion is treated as a root directory. The movie resource portion of AVIF0000.MOV contains the sample size and chunk offset that designate the property data, title data, thumbnail picture data, intro-music data, and so forth contained in the movie

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data portion of AVIF0000.MOV.

At this point, since the title data contains a file name, AVIF0001.MOV is designated as a lower hierarchical directory. Since AVIF0001.MOV has the QuickTime movie file format, the property data designates AV000001.MOV and AV000002.MOV as other (lower hierarchical) directories. Thus, data can be hierarchically handled in such a hierarchical file structure.

As shown in Fig. 15, the index file is recorded at a predetermined position (for example, the innermost peripheral position 21) of the disc shaped record medium 20. When a reproducing and editing mode gets started, the index file is initially reproduced. Thus, when the reproducing and editing mode gets started, a searching screen as shown in Fig. 2 is displayed. Conventional AV files are recorded in the other record area.

According to the embodiment of the present invention, data of the index file for searching a desired AV file is output using the display panel, the speaker, or the like of the recording apparatus. In addition, the present invention can be applied to the case that the reproducing and editing operation is performed using an external apparatus that outputs video data, audio data, and/or the like.

The present invention is not limited to the

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compression-encoding method used in recording video data, audio data, and/or the like. Instead, the present invention can be applied to data that can be handled in for example QuickTime movie file format.

5   According to the present invention, outlined information of each of a plurality of files recorded on a disc shaped record medium is output. With reference to the outlined information, a desired file can be easily searched.

10   Thus, when the reproducing and editing operation is performed, data to be operated can be easily accessed and thereby the operability can be improved.

          Although the present invention has been shown
15 and described with respect to a best mode embodiment thereof, it should be understood by those skilled in the art that the foregoing and various other changes, omissions, and additions in the form and detail thereof may be made therein without departing from the spirit
20 and scope of the present invention.